CORPORATE FORECASTING

A FORECASTING MODEL OF EDMONTON BUILDING PERMIT VALUES

Research Paper No. 4

THE CITY OF Edmonton PLANNING AND BUILDING

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A FORECASTING MODEL OF EDMONTON BUILDING PERMIT VALUES

by

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IMPORTANT NOTE

This Technical Paper has been prepared by the Corporate Forecasting Group, Long Range Planning Branch, Planning and Building Department. The paper documents research results as part of an ongoing forecasting activity. Neither the methods or results have been endorsed by the City of Edmonton.

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1. INTRODUCTION

This paper presents an econometric model to forecast annual building permit values for the City of Edmonton. Permit values are important to the Planning and Building Department because they provide revenue to the Department and affect tax levy requirements.

The model is not intended to replace the Planning and Building Department's current method of forecasting building permits, whereby annual forecasts are prepared and adjusted on a monthly basis considering building activity and a list of major projects. Instead, the model is intended to serve as a complementary method where the approach to forecasting is completely different, but where the results can be compared and assessed.

The model was developed to test the hypothesis that the variation in the annual building permit values were caused by some socio-economic variables. Given the volatility of permit values over the past five years and the impact that one or two large scale projects may have on permit values, the reader is cautioned regarding the application of the results presented in this paper.

2. THEORETICAL EXPLORATION

Building permits are assumed to be influenced by a number of socio-economic variables. The following is a list of these variables and a description of the theoretical basis for their use in the estimation of building permit values:

Real Mortgage Rates - Since most building activity is financed through lending institutions, real mortgage rates are expected to play an important part in a developer's decision to build. The expected relationship between building

permit values and real mortgage rates is negative since higher real mortgage rates are likely to lead to less construction activity.

Office Vacancy Rates - During periods of high office vacancy rates, little or no office construction is likely to occur. The opposite would be expected for low vacancy rates. Therefore, office vacancy rates are expected to have a negative relationship with building permit values.

Apartment Vacancy Rates - The same rationale for office vacancy rates is expected to apply to apartment vacancy rates.

Alberta Gross Domestic Product - Provincial economic growth is likely to lead to a growth in the provincial infrastructure and other construction activity, thus an increase in building permits. The expected relationship between Alberta Gross Domestic Product and building permit values is expected to be positive.

Population Growth - Population growth is likely to lead to an increase in building activity as the greater population requires more homes, stores and other facilities. The expected relationship between population and building permit values is positive.

Net Migration - The same rationale for population growth is likely to apply to net migration.

3. ESTIMATION OF THE MODEL

To test the relationship between building permit values and the socio-economic variables listed in the previous section, the Ordinary Least Squares technique was used. All data are annual from 1971 to 1985. Building permit values were deflated using the Canadian construction price index. Three equations are presented to estimate total building permit values, with each reflecting a different set of socio-economic variables. Residential and non-residential building permit values are each represented by a separate equation.

A list of variables and their data for the period 1971 to 1985 are shown in Appendix A. A list of all estimated equations are displayed in Appendix B. These equations did not perform as well as the five equations presented in the report, but are included to complete the analysis.

3.1 Total Building Permit Values

Equation 1

RBPT =	264.42 +	10.60 NETMIG +	3.38 NETMIG1 -	9.51 APTVAC1
	(11.44)	(5.35)	(1.44)	(2.42)

R^2 = .935 R^{-2} = .917 SEE = 29.35 DW = 1.85

Where:

RBPT	=	Total building permit values in millions of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
NETMIG1	=	Edmonton net migration in the previous year in thousands of persons
APTVAC1	=	Edmonton apartment vacancy rate in the previous year
R^2	=	Coefficient of determination
R^{-2}	=	Coefficient of determination corrected for degree of freedom
SEE	=	Standard error of estimates
DW	=	Durbin-Watson statistic

Figures in parenthesis are Students "t" statistic. The "t" test indicates that all the explanatory variables are statistically significant at the 90% or more level of confidence

The above relationship indicates that net migration is the most significant factor affecting Edmonton total building permit values. A one percent rise in apartment vacancy rate is expected to reduce total building permit values by $9.5 million (1971 dollars). The three variables used in the equation explain approximately 93.5% of Edmonton's total building permit values over the period 1971-1985.

Equation 2

RBPT =	237.62 +	10.64 NETMIG +	7.62 NETMIG1 -	5.21 RMORT
	(12.89)	(4.61)	(3.54)	(1.60)

R^2 = 0.919 R^{-2} = .897 SEE = 32.733 D.W. = 1.70

Where:

RBPT	=	Total building permit values in millions of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
NETMIG 1	=	Edmonton net migration in the previous year in thousands of persons
RMORT	=	Real mortgage rates
R^2	=	Coefficient of determination
R^{-2}	=	Coefficient of determination corrected for degree of freedom
SEE	=	Standard error of estimates
DW	=	Durbin-Watson statistic

Figures in parenthesis are Students "t" statistic, indicating that all the explanatory variables are statistically significant at the 90% or more level of confidence.

The above relationship indicates that net migration is the most significant factor affecting Edmonton total building permit values. A one percent point increase in real mortgage rates is expected to cause a decline in total building permits by

$5.2 million (1971 dollars). The three variables used in the equation explain approximately 91.9% of Edmonton's total building permit values over the period 1971-1985.

Equation 3

$$\begin{aligned} RBPT = {} & 171.63 + 8.70\ NETMIG + 6.95\ NETMIG1 - 10.22\ RMORT \\ & (2.61) \quad (2.94) \quad (3.11) \quad (1.77) \\ & + 0.33\ EDEMP \\ & (1.05) \end{aligned}$$

$R^2 = .927$ $R^{-2} = .898$ SEE = 32.59 DW = 1.75

Where:

RBPT	=	Total building permit values in millions of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
NETMIG1	=	Edmonton net migration in the previous year in thousands of persons
RMORT	=	Real mortgage rates
EDEMP	=	Edmonton employment in thousands of persons
R^2	=	Coefficient of determination
R^{-2}	=	Coefficient of determination corrected for degree of freedom
SEE	=	Standard error of estimates
DW	=	Durbin-Watson statistic

Figures in parenthesis are Students "t" statistics. The "t" test indicates that all the explanatory variables are statistically significant at the 80% or more level of confidence.

The above relationship also indicates that net migration is the most significant factor affecting Edmonton total building permit values. Real mortgage rates and Edmontom employment are also significant in determining total building permit values. The four variables used in the equation explain approximately 92.7% of Edmonton's total building permit values over the period 1971-1985.

3.2 Residential Building Permit Values

Equation 4

RRESBP =	173.24 +	3.82 NETMIG +	2.49 RMORT -	11.90 APTVAC1
	(10.63)	(2.50)	(1.05)	(4.53)

R^2 = .89 R^{-2} = .868 SEE = 23.367 D.W. = 1.39

Where:

RRESBP	=	Residential building permit values in million of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
RMORT	=	Real mortgage rates
APTVACLI	=	Edmonton apartment vacancy rates in the previous year
R^2	=	Coefficient of determination
R^{-2}	=	Coefficient of determination corrected for degree of freedom
SEE	=	Standard error of estimates
DW	=	Durbin-Watson statistic

Figures in parenthesis are Students "t" statistics, indicating that all the explanatory variables are statistically significant at the 80% or more level of confidence.

The above relationship indicates that Edmonton apartment vacany rates in the previous year are the most significant factor affecting residential building permit values. Net migration and real mortgage rates are also important. The three variables used in the equation explain approximately 89% of Edmonton's residential building permit values over the period 1971-1985.

3.3 Non-Residential Building Permit Values

Equation 5

RNRESBP=	41.23 +	3.63 NETMIG +	16.79 RGDP -	3.86 OFFVACL1
	(1.10)	(2.81)	(4.42)	(3.56)

R^2 = .879 R^{-2} = .846 SEE = 19.77 DW = 1.71

Where:

RNRESBP	=	Non-residential building permit values in millions of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
RGDP	=	Real gross domestic product
OFFVAC1	=	Office vacancy rate in the previous year
R^2	=	Coefficient of determination
R^{-2}	=	Coefficient of determination corrected for degree of freedom
SEE	=	Standard error of estimates
DW	=	Durbin-Watson statistic

Figures in parenthesis are Students "t" statistics. The "t" test indicates that all the explanatory variables are statistically significant at the 99% or more level of confidence

The above relationship indicates that real gross domestic product is the most significant factor affecting Edmonton non-residential building permit values. Net migration and office vacancy rates are also instrumental in affecting non-residential building permit values. The three variables used in the equation explain approximately 87.9% of Edmonton's non-residential building permit values over the period 1971-1985.

4. BUILDING PERMIT VALUE FORECASTS

Each of the five estimated equations relates building permit values to such economic factors as net migration, real mortgage rates, Alberta's general

economic activity, Edmonton employment, and apartment and office vacancy rates. In order to forecast building permit values for the period 1986 to 1991, forecasts of these variables are required. The following table lists all forecast variables used to forecast building permit values.

Table 1

Forecast of Economic Variables Used in Building Permit Model*

	1986	1987	1988	1989	1990	1991
Edmonton Net Migration	-1,200	900	1,500	2,100	3,000	4,500
Real Mortgage Rates	8.75	7.00	6.35	5.60	4.75	3.80
Edmonton Apartment Vacancy Rates	5.9	3.5	3.0	3.0	3.0	3.0
Edmonton Employment (thousands)	353	360	368	377	387	398
Edmonton Office Vacancy Rates	20.8	19.7	16.0	17.3	15.0	13.0
Real Gross Domestic Product ($ Billions)	14.384	14.672	15.039	15.490	16.032	16.673

*Source: City Forecast Committee, Socio-Economic Forecasts, 1986-1991 (June 1986)

Applying the above forecasts to each of the five equations, the results are shown in Table 2. Values are converted to current dollars by adjusting the Canadian construction price index with the inflation rates forecast in the "Socio-Economic Forecasts, 1986-1991 (June 1986)".

Table 2

Forecast of Building Permit Values 1986-1991
($ millions)

	1986	1987	1988	1989	1990	1991
Total Building Permit Values						
Equation 1	608	764	866	921	1003	1119
Equation 2	532	651	773	848	952	1099
Equation 3	566	707	843	938	1066	1237
City Forecast Committee*	400	430	460	500	550	610
Residential						
Equation 4	245	380	433	461	501	553
Non-Residential						
Equation 5	634	694	807	847	961	1059

*Source: City Forecast Committee, Socio-Economic Forecasts, 1986-1991 (June 1986)

All results obtained from the model are significantly higher than those forecast by the City Forecast Committee. The lowest value forecast for total values in 1986 is $532 million in Equation 2. For the same year the City Forecast Committee is predicting a value of $400 million. If the residential and non-residential values from Equations 4 and 5 for 1986 are combined, the value obtained is more than double the City Forecast Committees total ($879 million versus $400 million). By 1991 there is an even greater variation between the model's total values and those forecast by the City Forecast Committee. The lowest value in the model,

Equation 2, has a value of $1,099 million while the City Forecast Committee has a value of $610 million.

5. CONCLUSIONS

The equations produced by the model identify a strong relationship between permit values and certain socio-economic conditions affecting the Edmonton economy. In particular, Edmonton net migration, real mortgage rates, Alberta's economic activity, Edmonton employment, office and apartment vacancy rates are shown to have an important impact on building permit values. The relationships identified in Equations 1 to 5 and listed below, allow forecasts of Edmonton building permit values to reflect socio-economic forecasts for Edmonton.

Equations Used in Model

(1) RBPT = 264.42 + 10.60 NETMIG + 3.38 NETMIG1 - 9.51 APTVAC1

(2) RBPT = 237.62 + 10.64 NETMIG + 7.62 NETMIG1 - 5.21 RMORT

(3) RBPT = 171.63 + 8.70 NETMIG + 6.95 NETMIG1 - 10.22 RMORT + 0.33 EDEMP

(4) RRESBP = 173.24 + 3.82 NETMIG - 2.49 RMORT - 11.90 APTVAC1

(5) RNRESBP = 41.23 + 3.63 NETMIG + 16.79 RGDP - 3.86 OFFVAC1

Where:

RBPT	=	Total building permit values in millions of 1971 dollars
RRESBP	=	Residential building permit values in millions of 1971 dollars
RNRESBP	=	Non-residential building permit values in millions of 1971 dollars
NETMIG	=	Edmonton net migration in thousands of persons
NETMIG1	=	Edmonton net migration in the previous year in thousands of persons
APTVAC1	=	Edmonton apartment vacancy rates in the previous year
RMORT	=	Real mortgage rates
EDEMP	=	Edmonton employment in thousands of persons
OFFVAC1	=	Office vacancy rates in the previous year

Although the results produced in this model appear too high at this time relative to the City Forecast Committee's numbers, building permit values and the socio-economic variables described in the model, will be monitored closely in the future in an attempt to further refine the model. Also, as revised forecasts input variables are made available, they will be incorporated into the equations to prepare new building permit value forecasts.

APPENDIX A

VARIABLE NAMES AND HISTORICAL DATA

1.	YEAR	Year 1971-1985
2.	TOTALBP	total building permit values in millions of dollars
3.	RESIDENTIAL	residential building permit values in millions of dollars
4.	NON-RES	non-residential building permit values in millions of dollars
5.	NETMIG	Edmonton net migration in thousands of persons
6.	APTVAC	Edmonton apartment vacancy rate
7.	CON.P.I.	Construction price index
8.	PRIMERATE	Prime lending rate
9.	RMORT	Real mortgage rate
10.	EDMEMP	Edmonton employment in thousands of persons
11.	RGDP	Real Alberta Gross Domestic Product in billions of 1971 dollars
12.	RBPT	Real total building permit values in millions of 1971 dollars
13.	RRESBP	Real residential building permit values in millions of 1971 dollars
14.	RNRESBP	Real non-residential building permit values in millions of 1971 dollars
15.	NETMIG1	Edmonton net migration in the previous year in thousands of persons
16.	NETMIG2	Edmonton net migration for the two years previous in thousands of persons
17.	RGDP1	Real Alberta Gross Domestic Product lagged one year in billions of 1971 dollars
18.	RGDP2	Real Alberta Gross Domestic Product lagged two years in billions of 1971 dollars
19.	OFFICEVAC	Edmonton office vacancy rates
20.	OFFVAC1	Edmonton office vacancy rates lagged one year
21.	OFFVAC2	Edmonton office vacancy rates lagged two years
22.	APTVAC1	Edmonton apartment vacancy rates lagged each year
23.	VACRATEINX	Index of apartment and office vacancy rates averaged for each year
24.	VACRATINX1	Index of apartment and office vacancy rates averaged for each year lagged one year

YEAR	TOTALBP	RESIDENTIAL	NON-RES	NETMIG
1971	200.144	103.402	96.742	-759
1972	191.016	90.360	100.656	-4.434
1973	200.673	77.656	123.017	-1.848
1974	266.684	72.244	194.400	1.221
1975	341.120	188.610	152.510	5.054
1976	484.656	290.990	193.666	4.698
1977	629.570	376.789	252.781	1.427
1978	746.226	460.159	286.067	8.056
1979	798.171	391.703	397.468	8.874
1980	873.200	344.994	528.206	9.282
1981	1157.038	523.902	633.136	13.625
1982	802.627	328.425	474.202	1.115
1983	583.243	204.927	378.316	-3.610
1984	333.930	111.771	222.159	-4.000
1985	481.420	145.400	336.020	-1.700

YEAR	APTVAC	CON.P.I.	PRIMERATE	RMORT	EDMEMP
1971	6.30	1.000	6.48	3.02	199
1972	7.60	1.095	6.00	4.61	194
1973	7.30	1.225	7.65	3.02	208
1974	3.40	1.348	10.75	1.38	233
1975	.55	1.454	9.42	2.70	268
1976	.10	1.676	10.04	3.81	28
1977	.15	1,846	8.50	1.33	270
1978	.80	2.012	9.69	.48	290
1979	2.45	2.192	12.90	1.99	310
1980	1.95	2.319	14.25	4.42	332
1981	1.80	2.568	19.29	5.78	356
1982	4.00	2.729	15.81	7.24	347
1983	8.50	3.033	11.20	7.43	332
1984	10.45	3.036	12.10	10.88	328
1985	5.90	3.17	10.70	8.93	349

YEAR	RGDP	RBPT	RRESBP	RNRESBP	NETMIG1
1971	7.866	200.144	103.402	96.742	-.271
1972	8.457	174.444	82.521	91.923	-.759
1973	9.296	163.815	63.393	100.422	-4.343
1974	9.688	197.837	53.593	144.243	-1.848
1975	10.139	234.603	129.718	104.885	1.221
1976	10.594	289.173	173.622	115.551	5.054
1977	11.186	341.045	204.111	136.934	4.698
1978	11.975	370.888	228.707	142.180	1.427
1979	13.227	360.023	178.697	181.326	8.056
1980	13.906	376.542	148.763	227.774	8.874
1981	14.553	450.560	204.012	246.548	9.282
1982	13.870	294.110	120.346	173.764	13.625
1983	13.442	192.299	67.566	124.733	1.115
1984	13.629	106.482	35.641	70.841	-3.610
1985	14.242	151.724	45.824	105.899	-4.000

YEAR	NETMIG2	RGDP1	RGDP2	OFFICEVAC	OFFVAC1
1971	.767	7.373	7.146	2.5	2.0
1972	-.271	7.823	7.373	1.1	2.5
1973	-.759	8.375	7.823	1.0	1.1
1974	-4.343	9.202	8.375	3.4	1.0
1975	-1.848	9.686	9.202	1.6	3.4
1976	1.221	10.139	9.686	2.4	1.6
1977	5.054	10.594	10.139	10.2	2.4
1978	4.698	11.186	10.594	6.2	10.2
1979	1.427	11.975	11.186	3.1	6.2
1980	8.056	13.227	11.975	8.7	3.1
1981	8.874	13.906	13.227	2.5	8.7
1982	9.282	14.553	13.906	14.3	2.5
1983	13.625	13.870	14.553	24.8	14.3
1984	1.115	13.442	13.870	22.0	24.8
1985	-3.610	13.629	13.442	21.8	22.0

YEAR	OFFVAC2	APTVAC1	VACRATEINX	VACRATINX1	RMORT1
1971	2.0	6.30	100	100	3.00
1972	2.0	6.30	82	100	3.02
1973	2.5	7.60	62	82	4.61
1974	1.1	7.30	74	62	3.02
1975	1.00	3.40	34	74	1.38
1976	3.4	.55	48	34	2.70
1977	1.6	.10	205	48	3.81
1978	2.4	.15	130	205	1.33
1979	10.2	.80	77	130	.48
1980	6.2	2.45	183	77	1.99
1981	3.1	1.95	59	183	4.42
1982	8.7	1.80	318	59	5.78
1983	2.5	4.00	563	318	7.24
1984	14.3	8.50	523	563	7.43
1985	24.8	10.45	470	523	10.88

APPENDIX B

REGRESSIONS TESTED IN THE MODEL

1. RBPT = 219.08 + 16.65 NETMIG
(17.27) (7.75)

R^2 = .82 SEE = 44.62 D.W. = 1.41

2. RBPT = 66.60 + 16.52 RGDP
(.49) (1.44)

R^2 = .14 SEE = 98.14 D.W. = 0.41

3. RBPT = 121.07 + 12.35 RGDP1
(.95) (1.11)

R^2 = .087 SEE = 101.009

4. RBPT= 237.62 + 10.65 NETMIG + 7.62 NETMIG1 - 5.21 RMORT
(12.89) (4.61) (3.54) (1.60)

R^2 = .92 SEE = 32.73 D.W. = 1.70

5. RBPT = 110.75 + 11.65 NETMIG + .61 EDMEMP - 12.17 RMORT
(1.32) (3.11) (1.50) (1.58)

R^2 = .859 SEE = 43.62 D.W. = 1.23

6. RBPT = 68.05 + .67 EDMEMP
(.50) (1.45)

R^2 = .14 SEE = 98.11 D.W. = 0.40

7. RBPT = 244.73 + 8.38 NETMIG + 10.66 NETMIG1 - 13.44 RMORT
(10.34) (2.82) (3.69) (2.07)

\+ 3.58 OFFVAC1 + .54 APTVAC
(1.64) (.11)

R^2 = .937 SEE = 31.73 D.W. = 2.05

8. RBPT = 218.10 + 8.15 NETMIG + 9.90 NETMIG1 - 13.74 RMORT
(2.06) (2.50) (2.34) (1.98)

\+ 2.89 OFFVACL1 + .61 APTVAC + 2.99 RGDP
(.82) (.11) (.26)

R^2 = .938 SEE = 33.52 D.W. = 1.99

9. RBPT = 260.71 + 8.79 NETMIG + 7.45 NETMIG1 - 8.39 RMORT + 2.44 OFFVAC1
(10.62) (3.31) (1.66) (1.08) (.99)

\- 5.121 APTVAC1
(.86)

R^2 = .94 SEE = 30.52 D.W. = 1.93

10. RBPT = 258.68 + 11.33 NETMIG + 2.45 NETMIG1 + 3.89 RMORT 1
(10.83) (5.35) (.97) (.98)

\- 11.82 APTVACL1
(-2.58)

R^2 = .94 SEE = 29.41 D.W. = 1.66

11. RBPT = 264.42 + 10.60 NETMIG + 3.38 NETMIG1 - 9.50 APTVAC1
(11.44) (5.35) (1.44) (2.42)

R^2 = .93 SEE = 29.41 D.W. = 1.66

12. RBPT = 265.22 + 10.31 NETMIG + 4.08 NETMIG1 - 1.59 RMORT
(11.00) (4.77) (1.38) (.43)

- 8.24 APTVAC1
(1.63)

R^2 = .93 SEE = 30.51 D.W. = 1.81

13. RBPT = 211.52 + 8.42 NETMIG + 5.38 NETMIG1 - 8.06 RMORT +
(2.13) (2.94) (.87) (.99)

.89 OFFVAC1 -6.03 APVAC1 + 5.84 RGDP
(.22) (.93) (.51)

R^2 = .94 SEE = 31.86 D.W. = 1.79

14. RBPT = 241.23 + 12.36 NETMIG + 7.73 NETMIG1 - 1.05 EDMEMP + 23.05 RGDP
(4.48) (5.52) (3.18) (1.20) (1.07)

R^2 = .91 SEE = 35.35 D.W. = 1.69

15. RBPT = 237.62 + 10.65 NETMIG + 7.62 NETMIG1 - 5.21 RMORT
(12.89) (4.61) (3.54) (1.60)

R^2 = .92 SEE = 32.73 D.W. = 1.70

16. RBPT = 250.67 + 10.44 NETMIG + 2.95 NETMIG1 - 10.03 APTVAC1 + 1.49 RGDP
(5.35) (4.93) (1.07) (2.29) (.34)

R^2 = .93 SEE = 30.60 D.W. = 1.83

17. RBPT = 171.63 + 8.71 NETMIG + 6.95 NETMIG1 - 10.22 RMORT + .33 EDMEMP
(2.61) (2.94) (3.11) (1.77) (1.05)

R^2 = .93 SEE = 32.60 D.W. = 1.75

18. RBPT = 266.58 + 10.63 NETMIG + 3.44 NETMIG1 - 9.43 APTVAC1 - .01 EDMEMP
(5.65) (5.01) (1.24) (2.17) (.05)

R^2 = .93 SEE = 30.78 D.W. = 1.85

19. RBPT = 219.80 + 12.21 NETMIG + 6.35 NETMIG1 - .04 VACRATINX1
(12.95) (5.39) (2.63) (.56)

R^2 = .90 SEE = 35.85 D.W. = 1.62

20. RBPT = 266.18 + 12.62 NETMIG + 8.15 NETMIG1 + .03 VACRATINX1 - .22 EDMEMP
(2.39) (4.96) (1.65) (.18) (.42)

R^2 = .90 SEE = 37.27 D.W. = 1.73

21. RBPT = 423.01 + 21.19 NETMIG + 8.05 NETMIG1 + .35 VACRATEINX
(3.14) (3.96) (1.79) (1.78)

- .04 VACRATINX1 - 1.07 EDMEMP
(.23) (1.59)

R^2 = .93 SEE = 33.81 D.W. = 1.76

22. RRESBP = 132.29 + 5.25 NETMIG + 3.77 NETMIG1 - 7.23 RMORT
6.60 (2.09) (1.61) (2.05)

R^2 = .76 SEE = 35.58 D.W. = 1.20

23. RRESBP = 149.55 + 3.62 NETMIG - 5.91 APTVAC + 2.97 NETMIG1 - 4.33 RMORT
(5.73) (1.22) (1.03) (1.21) (.96)

R^2 = .78 SEE = 35.48 D.W. = 1.36

24. RRESBP = 187.97 + 4.15 NETMIG - 1.85 APTVAC - 2.91 NETMIG1 + .26 RMORT
(9.31) (2.70) (.47) (1.28) (.08)

-15.00 APTVACL1
(3.70)

R^2 = .91 SEE = 23.55 D.W. = 1.30

25. RRESBP = 165.37 + 4.01 NETMIG - .05 RMORT1 - 12.75 APTVAC1
(9.41) (2.44) (.02) (4.49)

R^2 = .89 SEE = 24.51 D.W. = 1.26

26. RRESBP = 173.24 + 3.82 NETMIG - 2.49 RMORT - 11.90 APTVAC1
(10.63) (2.50) (1.05) (4.53)

R^2 = .896 SEE = 23.367 D.W. = 1.39

27. RRESBP = 184.11 + 4.71 NETMIG - 3.08 NETMIG1 - 15.86 APTVAC1
(10.83) (3.23) (1.78) (5.50)

R^2 = .911 SEE = 21.58 D.W. = 1.37

28. RRESBP = 97.19 + 7.56 NETMIG + 2.63 NETMIG1
(8.33) (3.00) (1.03)

R^2 = .667 SEE = 40.03 D.W. = .85

29. RRESBP = 165.22 + 4.01 NETMIG - 12.77 APTVAC1
(11.43) (2.63) (5.10)

R^2 = .886 SEE = 23.46 D.W. = 1.26

30. RRESBP = 184.32 + 4.64 NETMIG - 2.89 NETMIG1 - .42 RMORT - 15.53 APRVAC1
(10.32) (2.89) (1.32) (.15) (4.15)

R^2 = .911 SEE = 22.61 D.W. = 1.37

31. RNRESBP = - 41.23 + 3.6 NETMIG + 16.79 RGDP - 3.86 OFFVAC1
(1.10) (2.81) (4.42) (3.56)

R^2 = .88 SEE = 19.77 D.W. = 1.71

32. RNRESBP = - 67.63 + 3.70 NETMIG + 19.81 RGDP - 1.26 NETMIG1
(1.07) (2.76) (2.86) (.53)

- 4.71 OFFVACL1
(2.41)

R^2 = .88 SEE = 20.449 D.W. = 1.63

33. RNRESBP = - 42.18 + 3.84 NETMIG + 16.60 RGDP - 3.67 OFFVAC2
(.91) (2.11) (3.15) (2.80)

- .82 OFFVAC2 + 1.34 RMORT
(.60) (.36)

R^2 = .885 SEE = 21.32 D.W. = 1.69

34. RNRESBP = -27.92 + 3.82 NETMIG - .85 EDMEMP + 36.24 RGDP
1.69.44) (.3.04) (1.63) (3.00)

+.32 NETMIG1 - 3.61 OFFVAC1
(.13) (1.85)

R^2 = .908 SEE = 19.07 D.W. = 1.93